

ABSTRAK

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Proses pelepasan dan pemasangan *coil spring* (per keong) pada sistem suspensi kendaraan roda empat merupakan salah satu pekerjaan perawatan yang memiliki risiko keselamatan tinggi. Penggunaan alat bantu manual yang tidak standar sering kali menyebabkan kecelakaan kerja akibat lepasnya tekanan pegas secara tiba-tiba, serta membutuhkan waktu dan tenaga mekanik yang besar. Penelitian ini bertujuan untuk merancang bangun alat *Hydraulic Coil Spring Compressor* yang aman, ergonomis, dan efisien untuk membantu proses pembongkaran suspensi. Metode perancangan yang digunakan mengacu pada tahapan perancangan produk mekanikal, meliputi identifikasi kebutuhan mekanik, perhitungan kekuatan material, pemilihan komponen hidrolik, hingga pemodelan desain tiga dimensi (3D). Alat ini dirancang menggunakan sistem aktuasi hidrolik berupa *hydraulic bottle jack* berkapasitas maksimal 2 ton untuk memberikan penekanan yang stabil dan konstan. Struktur rangka utama menggunakan material baja struktural pilihan yang dinilai mampu menahan beban kompresi tinggi tanpa mengalami deformasi plastis atau kegagalan struktur saat menerima tekanan maksimum. Desain pencekam (*jaw*) dibuat fleksibel dan dilapisi material pelindung agar dapat menyesuaikan berbagai diameter serta mencegah slip pada ulir *coil spring*. Hasil perancangan menunjukkan bahwa penggunaan mekanisme hidrolik secara signifikan dapat mereduksi tenaga fisik mekanik dan mempercepat waktu kompresi pegas dibandingkan metode mekanis konvensional. Analisis kekuatan struktur memastikan bahwa *safety factor* dari rangka memenuhi standar keamanan kerja. Melalui rancang bangun ini, diharapkan alat *Hydraulic Coil Spring Compressor* dapat menjadi solusi alternatif alat bantu perbengkelan yang mampu meningkatkan aspek keselamatan kerja (K3) serta efisiensi operasional pada proses perawatan sistem suspensi kendaraan.

Kata Kunci: Rancang Bangun, *Coil Spring Compressor*, Sistem Hidrolik, Suspensi, Keselamatan Kerja, Kekuatan Struktur.

ABSTRACT

Desain and construction of a hydraulic coil spring compressor (design)

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The removal and installation of coil springs in four-wheeled vehicle suspension systems is a maintenance task that carries a high safety risk. The use of non-standard manual tools often leads to workplace accidents due to the sudden release of spring pressure, requiring significant time and mechanical effort. This research aims to design a safe, ergonomic, and efficient Hydraulic Coil Spring Compressor to assist in the suspension disassembly process. The design method used refers to the stages of mechanical product design, including identifying mechanical requirements, calculating material strength, selecting hydraulic components, and modeling three-dimensional (3D) designs. This tool is designed using a hydraulic actuation system in the form of a hydraulic bottle jack with a maximum capacity of 2 tons to provide stable and constant compression. The main frame structure uses selected structural steel materials, which are considered capable of withstanding high compression loads without experiencing plastic deformation or structural failure under maximum pressure. The jaw design is flexible and coated with a protective material to accommodate various diameters and prevent slippage of the coil spring threads. The design results show that the use of a hydraulic mechanism can significantly reduce mechanical physical effort and accelerate spring compression time compared to conventional mechanical methods. Structural strength analysis ensures that the safety factor of the frame meets occupational safety standards. This design and construction is expected to provide an alternative workshop tool that can improve occupational safety (OHS) and operational efficiency in vehicle suspension system maintenance.

Keywords: Design, Coil Spring Compressor, Hydraulic System, Suspension, Occupational Safety, Structural Strength.